

Understanding software solutions in the routines of administrative employees of an oil company

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Abstract

Purpose – This study aimed to understand how administrative employees of an oil company perceive the role of software solutions in their routines.

Design/methodology/approach – Starting from an interpretive perspective, we used the phenomenographic method to analyze software solutions based on users' experience, by means of 20 interviews carried out between November 2020 and May 2021.

Findings – Interviewees ranked the function of software solutions in their routines in three categories: (1) information repository; (2) orchestration mechanism and (3) guidelines for action. Four explanatory dimensions were identified: (1) artifact performance; (2) configuration between actors; (3) degree of automation and (4) accountability aspects.

Research limitations/implications – The results expand knowledge on the role of software solutions in organizations. As players consider software essential to their routines, human agency in actions tends to decrease. Furthermore, the incorporation of digital elements in routines varies, based on how actors perceive their integration, from external tools to dominant elements that shape actions.

Practical implications – Respecting the autonomy of the actors involved in automated routines; ideally, automating routine steps that add value to the process.

Originality/value – The study explores the function of software solutions in organizational routines through the phenomenographic approach, presenting different concepts of that event.

Keywords Organizational routines, Technological artifacts, Digital transformation

Paper type Research paper

1. Introduction

Information technology (IT) is the cornerstone of companies, ranging from operational functions to the highest levels of strategic planning (Mansell, Avgerou, Silverstone, & Quah, 2007). In addition, the incorporation of new technologies is recognized as a strategy for identifying competitive opportunities (Faraj & Leonardi, 2022). Therefore, studies on the role of artifacts in routine dynamics present different perspectives, from peripheral elements to central ones (D'Adderio, 2021). Baralou and Dionysiou (2022) emphasized artifact centrality, allowing team members to trust them for performing general routine activities. According to the authors, virtual artifacts enable the connection of routine actions, thus facilitating the interaction between actors. For Omidvar, Safavi and Glaser (2023), algorithms are mechanisms for implementing organizations' daily routine operations. Hence, IT artifacts are essential in several ways, for both individuals and organizational routines (Zhang, Scialdone, & Ku, 2011).

In the field of studies on organizational routines, the theoretical development of materiality in routine dynamics presents three research paths: (1) artifacts understood as elements outside

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routine; (2) joint constitution with the other elements of routine and (3) the material turn, by highlighting the centrality of artifacts in routines, through the emergence of a fluid ontology, given the ability of artifacts to influence multiple representations, while routine has a temporary character of uniqueness (D'Adderio, 2021).

Artifacts do not determine the actions in the routines, but work as guidelines for such actions (Pentland & Feldman, 2008). Hence, artifacts are intrinsically flexible, given actors' appropriation of their relevance and influence. Artifacts have limitations of scope regarding the contextual complexity of operational practice; stated differently, artifacts were positioned as presenting the contextual background that constrains or enables emergent patterns of action (D'Adderio, 2021). D'Adderio (2001) identified that the appropriation and inclusion of an artifact in the routine occurs through actors' translation of its meanings.

Hence, this paper tried to understand how employees working in the administrative area of a state-owned firm understand the function of software solutions (technological artifacts) in performing business routines. We chose a specific oil company because of its well-structured administrative activities, which enable comparing related areas of other industries, and because it was undergoing a digital transformation during our research. We expect to contribute to the current understanding that actors are not the main agents in routines anymore, but it is the assemblage that comprises and affects them significantly (D'Adderio, 2021).

2. Theoretical background

2.1 Perspectives on strategy and orchestration in technological interventions

The field of strategy provides several possibilities for designing and implementing organizational goals, which range from traditional approaches to more inclusive and dynamic practices, as well as attempts to combine different perspectives (Langenmayr, Seidl, & Splitter, 2024). Traditional strategy formulation emphasizes formal analysis and top-down planning, assuming that only a few select people, mainly senior executives, have the vision and capacity to guide the organization's future through centralized decisions (Whittington, Caillaud, & Yakis-Douglas, 2011). In contrast, approaches like strategy-as-practice, described by Jarzabkowski (2005), and open strategy (Splitter, Jarzabkowski, & Seidl, 2023) foster a more decentralized vision, valuing the inclusion of a broad spectrum of stakeholders and the emergence of strategy from daily interactions and organizational practices.

In technology implementation, these perspectives require the coordination of resources and orchestrated activities between different actors within a network or ecosystem, in order to achieve common goals and understanding (Dhanaraj & Parkhe, 2006). Strategy-as-practice proposes a more organic and iterative process, involving multiple stakeholders at all organizational levels, highlighting the practical and localized nature of strategy, considering how practitioners build practice based on who they are, how they act and how they use resources, such as technology, in their routines (Seidl, Grossmann-Hensel, & Jarzabkowski, 2021).

On the other hand, open strategy suggests collaboration and co-creation when roles are not clear, encouraging transparency and sharing of ideas and solutions across different functional positions (Splitter et al., 2023). In that approach, actors from different hierarchical levels can engage in initiatives that bring transparency and inclusion to strategy, even when their goals are ambiguous (Stjerne, Gernaldi, & Wenzel, 2024).

2.2 Organizational routines: the perspective of organizational scholars

Organizational routines are a set of "repetitive, recognizable patterns of interdependent actions, carried out by multiple actors" (Feldman & Pentland, 2003, p. 95). Routines are part of organizations' dynamics, regardless of their nature (public or private), and have been studied since the beginning of the twentieth century. For some authors, routines can be "flexible and changeable," although others have considered them "fixed and unchanging" (Feldman et al., 2021). It was only in mid-1980s that organizational routines were analyzed

beyond their function as simple tools, to achieve specific goals (Baldessarelli, Lazaric, & Pezzoni, 2022).

For Feldman and Pentland (2003), organizational routines are based on ostensive and performative aspects, and are influenced by artifacts. According to D'Adderio (2021), artifacts represent the epicenter of routine dynamics. The performative aspect of routine refers to "the effective performance of specific people, at specific times, in specific places" (Pentland & Feldman, 2005, p. 795). Perceptions vary among individuals, giving them a multiple character and open to improvisation, which leads to differences in performance. Although these variations do not represent a change in routines, the performative aspect is the *locus* for the instability that will be the driving force for changing routines (Feldman *et al.*, 2021). Considering that (1) the routine's ostensive aspect is an abstract and general pattern, not necessarily formalized; and (2) the performative aspect refers to the endorsed perception of routine execution by individuals, understanding this dynamic demands recognizing the artifacts that are part of it as an expression of organizational routine (Pentland & Feldman, 2005).

Artifacts, which result from subjective interpretations of routines but are often understood as approximate representations, involve the interaction between the ostensive and performative dimensions (Feldman & Pentland, 2003), and D'Adderio (2008) emphasizes their key role in routines. Recognizing the centrality of artifacts underlines their crucial function in distributing the power of agency between the actors involved (D'Adderio, 2011); especially when seen as an approximation of routines' ostensive aspects, artifacts often become the focus in their relationship with the performative dimensions of routine.

2.3 Artifacts and materiality in routine theory

D'Adderio (2021) argues that "artifacts, technology, and materiality are different but overlapping concepts that have been received many different meanings over time and across different academic domains" (p. 99). The author briefly defines artifacts as "objects created by humans for a specific purpose" (D'Adderio, 2021). However, their materiality, whether physical or digital, is defined by their mode, timing and purpose of use (Leonardi, 2010). Orlikowski and Scott (2008) introduced the concept of sociomateriality as a research path that highlights the intertwining of technical and social elements.

IT artifacts, mainly software solutions and information systems (Zhang *et al.*, 2011), are essential for digital changes, which leverage technology to enhance significantly company performance, internal processes and customer value delivery (Westerman, Calm ejane, Bonnet, Ferraris, & McAfee, 2011). Digital artifacts, like algorithms in software, can reduce biases in operational decisions, but may also reflect their creators' biases (Davenport & Miller, 2022). In addition, individuals can adopt several strategies to resist algorithmic control in operations (Kellogg, Valentine & Christin, 2019).

Lepratte and Yoguel (2023) contribute to this discussion by arguing that AI-based technological solutions are emerging properties of human-artifact co-production processes and networks, and stress that service innovation with AI arises from sociotechnical assemblages involving relevant actors, digital artifacts and routine dynamics. This expands D'Adderio's (2021) understanding of the complex relationship between artifacts and organizational routines, showing the transformation of the theoretical field. Artifacts, as explored by Costa, Nascimento, Silva, and Jer onimo (2024), have a potential role, defined by their creators and based on their intended use in routines, and a performed role, which emerges through their effective engagement in routines. The study highlights the mutual constitution of these functions - as artifacts are incorporated into routines, their performed role evolves, thereby shaping and expanding their potential role. Thus, artifacts are not passive, but actively shape and are shaped by human agency and routines, in a continuous and situated interaction that makes their functions and purposes continuously evolve through their use in specific contexts and connections with other actors, including humans and other artifacts.

Kiær (2024) discusses the concept of Fluid Technologies as objects that can change into different versions, while keeping their essence. Regarding routine dynamics, this fluidity allows artifacts to be shaped and adapted to local practices, but also imposes restrictions on certain approaches. The flexibility of routines enables objects, even when modified, to keep functioning as tools for context-based practices, highlighting the adaptability of artifacts in organizational contexts.

Gao and Yang (2023) examined how human actors engage in artifact-based explorative and exploitative activities, providing insights on how social and material settings influence the development of routines over time. This complex interaction supports D'Adderio (2021), who argues that artifacts act as proxies for ostensive aspects of organizational routines, immersed in actors' specific performances. Therefore, routine dynamics express multiple versions of them (fluid ontology), shaped by sociomaterial practices, which need coordination for a temporary singular routine (ontological singularity) with variations, constantly challenged by distinct standards and performances influenced by sociomaterial agency.

3. Method

Among several available qualitative methods, we chose one that would consider different dimensions of the problem, from the perspective of 20 company employees who perform administrative routines, who were interviewed and brought their subjective perceptions. With this purpose, we used the theoretical-methodological approach of phenomenography to reach their different conceptions about a given phenomenon (Marton, 1988), which allowed us to design the practical application of the organizational routines under study.

One of the challenging aspects of this study was the choice of persons from different sectors in the administrative area. Employees were selected from all divisions of an oil company, with a wide age range and years of service, to increase diversity. We intended to get a variety of explanatory dimensions that would enable understanding employees' experiences on how software solutions affected their organizational routines. Another challenge was doing interviews during the COVID-19 pandemic.

3.1 Data collection

Semi-structured interviews are the standard data collection procedure in the phenomenographic method (Bowden & Walsh, 2000). Thus, we chose 23 employees of an oil company, and the interviews (three of them were tests) were conducted during working hours, from November 2020 to May 2021, by using a videoconference tool. Following Bowden's (2005) criteria, interviewees worked in the administrative area, and had different ages, genders, qualifications, positions/functions, years at the company and years of professional experience. All of them had known one of the researchers for around sixteen years. Table 1 shows their profile.

The interviews were conducted based on a script with two central questions and some follow-up ones. Central questions focused on organizational routines and experience with digital transformation, while follow-up questions sought to deepen the answers and describe examples.

All interviews were recorded and amounted to 10 hours and 33 minutes, with an average length of 32 minutes – the shortest was 21 minutes, and the longest was 48 minutes. The first three test interviews showed that participants had different ideas on the concept of organizational routine. Hence, the following interviewees received a definition based on Feldman and Pentland (2003) and Pentland and Feldman (2005), where “organizational routine is a repetitive and identifiable pattern of interdependent actions involving multiple actors”.

3.2 Data analysis

The 20 transcribed interviews amounted to 318 pages, organized in digital files; interviewees' names were replaced by “interviewee <number>”, and personal comments were removed to

Table 1. Interviewees' characteristics

Gender	Age	Unit	Position/Function	Years of experience	Years at company
Female	44	Accounting	Manager	21	20
Male	37	Human Resources [HR]	Manager	15	9
Male	57	HR	Position requiring high school education	38	34
Female	45	Corporate strategy	Manager	21	21
Male	52	External relationships	Coordinator	30	14
Female	48	Sales and logistics	Coordinator	22	12
Male	46	HR	Manager	22	15
Female	36	Corporate Social Responsibility [CSR]	Position requiring higher education	19	12
Male	56	President's office	Position requiring high school education	41	34
Male	48	Legal office	Manager	30	15
Female	45	Storage and warehouses	Manager	23	20
Male	44	Refinery logistics	Position requiring higher education	20	15
Female	35	Research center	Position requiring higher education	9	7
Male	35	Gas logistics	Position requiring higher education	13	11
Male	61	Corporate strategy	Consultant	33	18
Male	47	Performance	Position requiring higher education	28	18
Female	60	Digital transformation	Position requiring high school education	35	24
Male	45	Communication	Position requiring higher education	21	15
Male	47	Finance	Manager	17	12
Male	44	Governance	Position requiring higher education	20	14

Source(s): Authors' own work

mitigate proximity bias. All interviews were read at least six times. In the first reading, they were consolidated and analyzed. In the second, we gave more attention to issues related to software solutions and organizational routines, to allow the emergence of similar meanings from the experiences told by the interviewees (Marton, 1981). The third reading highlighted excerpts regarding the addressed phenomenon, and how each participant perceived it, and were coded with the assistance of Atlas.ti software. The first set of meanings related to the research problem emerged from these readings.

The selected excerpts were analyzed based on these meanings, questioning their relationship ("what", "how") with the way employees noticed their routines, considering the use of software solutions. Then, we reread the selected quotes in order to group them based on similarities and differences, defining categories (Marton, 1988). A new reading was done, to define the dimensions that explained different aspects related to their view within each category, thus building the outcome space. A final reading of all the categorized excerpts was done to validate the groups into descriptive categories, hierarchical relationships and explanatory dimensions. The analysis focused on interviews' transcription, seeking to standardize pre-existing concepts on the phenomenon under study among researchers (Bowden, 2005). Finally, the field researcher analyzed the transcriptions objectively to build the outcome space, disregarding any previous knowledge about the interviewees.

4. Results

After collecting, processing and analyzing the data, three descriptive categories emerged from the set of meanings for answering the research problem: (1) information repository; (2) orchestration mechanism and (3) guidelines for action. Following Marton and Booth (1997), the study assumed that descriptive categories should present different, qualitatively limited

ways of how scholars conceived the phenomenon. As a result, these categories were ranked from the simplest to the most complex, in a logic where the next category comprised the preceding one(s).

The similarities and differences between descriptive categories led to identifying the explanatory dimensions: (1) artifact’s performance; (2) configuration between actors; (3) automation degree and (4) accountability aspects. From there, we could identify the relationships between descriptive categories and explanatory dimensions, which gradually led to understanding software solutions as simple data repositories, moving on to mechanisms for orchestrating the routine and finally understood as guidelines for action.

The alignment between descriptive categories and their explanatory dimensions consolidates the understanding on the use of software solutions in an evolutionary process, from simple data repositories to an element for automating routines.

The outcome space (Table 2) shows the relationship between descriptive categories and explanatory dimensions. It presents the potential ways of experiencing the phenomenon, considering the research period and the interviewees (Åkerlind, 2005).

Artifact’s performance regards how software solutions relate to routine, based on employees’ experience of use. Configuration between actors describes the role of software solutions in executing organizational routines, from their interaction with multiple players (Pentland & Feldman, 2005). As interviews took place during the COVID-19 pandemic, this aspect was quite prevalent, concerning solutions designed to facilitate teleworking, both for interaction between the actors and for exchange and storage of records. Automation degree comprises the function of software solutions in increasing efficiency of routine operations, by adopting a low or high degree of automation in repetitive activities, and simplifying tasks related to data validation and reconciliation. Information accountability aspects address the role of information systems as a basis for compliance activities and process audit. The software solutions mentioned were, in general, collaborative work applications (Microsoft Teams), based on cloud computing, as well as Robotic Process Automation (RPA) solutions and workflow applications, developed by using low-code platforms (ServiceNow).

Each descriptive category discussed below covers the content of the explanatory dimensions, dialog with the underlying theory and excerpts from interviewees’ reports, and seeks to provide further result consistency.

Table 2. Outcome space

Explanatory Dimensions	Descriptive categories Information repository <i>Underlying principle:</i> keeping digital records	Orchestration mechanism <i>Underlying principle:</i> structuring tasks	Guidelines for action <i>Underlying principle:</i> automating routines
Artifact’s performance	Formalization of activities that make up routines	Connection of actions and actors in routines	Indication of actions for actors in routines
Configuration between the actors	Contact between individuals and systemic records	Formation of teams and work groups	Assignment of human and non-human agents to specific actions in routines
Automation degree	Low degree. Concentration and interconnection of routine execution records in databases	Medium to high degree. Reduction of setup time between activities through system parameterization	High degree. Gaining speed and reducing errors through predictive analytics and artificial intelligence
Accountability aspects	Records of the routine operation. Access can be protected	Organized retrieval of routine operation history, especially for checking and audit purposes	Automated controls and approvals, ensuring data reliability

Source(s): Authors’ own work

4.1 Information repository

This was the smallest descriptive category. The underlying principle in this category is keeping digital records to improve routines, by providing more accessible and less time-consuming ways to find the necessary information. Regarding artifact performance, actors noticed that software solutions help formalize the activities carried out. In many cases, relevant data that used to be transmitted through phone calls and electronic messages are now centralized in a software solution that formalizes a specific routine. Interviewees reported that it was easier to find information using these solutions, even before the social distancing measures adopted during the COVID-19 pandemic:

For information you needed, you had to send an e-mail asking the question to someone, and wait for the person to reply. Today, you have a database with several questions and answers; sometimes, when you have a question, you go to the database and, most of the time, for simpler questions, the answer is there (Interviewee 9).

In general, the emergence of digital technology in organizations' operations is attributed to the accessibility, storage, manipulation and retrieval of information (Huber, 1990), resulting in the idea of artifacts as sources of memory outside the routine (D'Adderio, 2011).

In the dimension "configuration between the actors", software solutions supporting routines are a common element for exchanging information that shows the history of actions with the record of the actors involved, who also use the system for interactions foreseen in the routine. This became even more frequent in reports during the COVID-19 pandemic, when all work interactions (meetings, messages, teamwork) were centered on videoconferences and online collaborative work tools. Regarding the degree of automation, the ease and convenience of processing information by using an integrated software solution for interaction between teams were highly appreciated. In some interviews, the ease of cross-referencing information between repositories for building panels and consultation sources was mentioned, making the work more productive and organized. "We created a FAQ with the most frequent questions asked to us, analysts, and we started to invest in knowledge dissemination" (Interviewee 20).

As for the dimension "accountability aspects", the reports mentioned a sense of security from actors when they achieved the possibility of keeping the information that emerged from routine through a software solution, thus feeling prepared to deal with audits and control bodies. This was observed especially because the company faces a very high regulatory burden: "[...] a system that was developed so that we could have a place to store all documents" (Interviewee 6).

This category indicates a basic use of systems for record-keeping as the first step in a journey of automating routines. As noted by D'Adderio (2011), based on seminal studies, the physical and digital elements around routines can be understood mainly as intervening in the context where routine actions take place. In this sense, artifacts are understood as components external to organizational routines, but often accessed for different purposes. Therefore, the use of information systems as data storage in organizational routines is the basis for a more organized environment in its constituent stages, as discussed below.

4.2 Orchestration mechanism

With the increasing complexity of routines and the ease of using software solutions for storing and accessing records, the orchestration mechanism emerged as a descriptive category, with the basic principle of structuring tasks. From this perspective, actions in routines are triggered through their relationship with the physical and digital elements that surround them, resulting in technological structures (Howard-Grenville, 2005).

Based on digitalized records, employees have a perception of structuring routine activities that use these records, expecting that the software solution can better indicate what should be done from the chain of actions, in an integrated way:

We live in a digital world; it makes no sense for us to ask analysts to investigate a lot of other FAGs [1], in an unstructured, disconnected way; it depends very much on each one's prior knowledge, and we could already be using it in a much more integrated way (Interviewee 18).

When managers seek certain configurations for routines, they usually make efforts based on artifacts' design, expecting to limit the abstract understanding of routines and achieve specific performances (Pentland & Feldman, 2008). Hence, artifacts affect the dynamics between ostensive and performative aspects (Feldman & Pentland, 2003), structures capable of formatting action into routines, enabling or restricting patterns of action (D'Adderio, 2021).

Regarding the configuration between actors, organizing the routine in information systems enabled overcoming temporal barriers (such as formal working hours), which was especially relevant when all employees started teleworking because of the pandemic. Even in the transition to a hybrid working model, routines organized in software solutions made it possible to have a common path for teams in different work regimes – a frequent complaint in a company where administrative and operational areas (working in shifts or social distancing) carry out the same routines.

For some interviewees, when considering artifacts' influence on the routines after digitalizing data and having the routine logic embodied in software parameters, the prospect of a bureaucratic process loses ground, due to performance gains from operating routines and achieving good results.

We have a system where managers can update their deliveries online, and we don't have to send spreadsheets for tracking routines, those follow-ups, those frequent monitoring activities that we used to do periodically (Interviewee 1).

Regarding accountability aspects, the digital organization of routines provides greater reliability in their execution. It facilitates retrieving past information, which is highly valued in a company subject to a high burden of inspections and audits.

I think there are several advantages; you record the conversation, it is stored there, you can be more objective... The interface makes it easier, in my case, to show graphs, tables, numbers, which is difficult by phone or chat. It's faster than email; the person receives the email but doesn't necessarily answer right away. With Teams, they usually respond much faster than by email. (Interviewee 11).

The interviewees envisioned the use of technological tools to link the tasks that make up their routines, and even guide those who perform them automatically. D'Adderio (2001) identified, in a study on software implementation, that the appropriation and inclusion of this artifact in the routine was accomplished through its meanings for the actors.

4.3 Guidelines for action

This category is driven by the underlying principle of automating routines, that is, minimizing the number of tasks done by human actors, expecting an increase in productivity. When considering the dimension of artifacts' performance, it is natural to associate the issue of automation with the reduction of time spent by employees in executing routines. Therefore, the use of technology provides routine actors with activities of higher quality and value creation, by automating repetitive and operational activities:

We managed to make the system capture everything that will come in, everything that will come out, all the money from the previous day in the accounts, and it gives you a vision: "You can invest that much at the beginning of the morning." [...] The system is completely parameterized. For example, when you deal with the days' payables, what you get has intelligence, which are the parameters you choose: "I want this, I don't want that (Interviewee 2).

Given the dimension "configuration between the actors", the parameterization of the work sequence for each person in the software and some routine decisions guarantee focusing only on what must be done, avoiding personal biases:

[...] we were discussing what could be done to improve, ideally automating it, to avoid depending on human intervention, because whenever it happens, we are hostages to the person that knows... by communication or the organization...” (Interviewee 13)

Regarding the dimension of automation degree, the actors deal more openly with complex technologies to eliminate human error, increasing the degree of automation in routines. When analyzing only the issue of structuring people’s routine, we observed the advantage of reducing people’s working hours by using software to do the same work they were doing before, and assigning these professionals to more sophisticated activities.

As for accountability aspects, the automated approvals and controls without human interference, provided by software solutions, bring greater reliability, according to interviewees’ perception. Often, these solutions are certified by external bodies, ensuring greater compliance in audit cases.

The category “guidelines for action” shows that many employees wish to rationalize their routines, assigning repetitive and operational activities to automated systems, with some simple decisions parameterized in the software that supports them. We found concern for increasing the performance of current routines with cutting-edge technologies, by carrying out more activities with the same number of workers in a much shorter cycle time. In addition, some interviewees complained about the time spent dealing with large volumes of information, and understood that this work could be fully digitalized, leaving them with the more analytical and subjective part of the routines.

If, on the one hand, there is a clear view that software solutions appropriate routines when they are made up as artifacts and reduce human activity for their execution, it is also clear that system parameterization limits the change of routine (and even establishing a new routine), which some interviewees found uncomfortable. From this perspective, the prevailing passive view of artifacts as “guides” and “delimiters” of actions shifts to entities that can actively shape action patterns, by means of what they are and what they can achieve with the actors (D’Adderio, 2021).

Therefore, we suggest that the increasing role of technology in carrying out routines, from its use as an information repository to a guideline for actions, shows that artifacts gradually become the central elements of routine execution and are essential to the dynamics of its evolution (D’Adderio, 2011). Hence, artifacts become part of routines, influencing human actions and forming sociomaterial assemblages. The performativity theory emphasizes the key function of artifacts in routines and their ability to incorporate specific performances by actors. This implies that artifacts have agency, shaping routines differently across contexts, without fully conforming to a universal concept of routine.

By understanding multidimensionality, Ewenstein and Whyte (2009) observed and suggested two types of objects: epistemic and limiting. “Epistemic” objects produce multiple abstract relationships with those involved in their appropriation, raising different implications for distinct actors, depending on their context, while “limiting” objects establish standards and “acceptable truths” for all persons. The results presented in this study show the operationalization of routines through the influence of limiting objects, since individuals conceived software solutions as artifacts capable of storing information, reconciling actions and actors and even suggesting which actions could be executed, from several options. Therefore, the limiting object is quite stable and concrete, although different reproductions of the routines may present several versions of themselves (fluid ontology), bringing disparity, dispersion and definitions, based on sociomaterial practices (D’Adderio, 2021).

From our results, we add to sociomaterial practices the following idea: since actors conceive the artifacts in their routines, they can also make several versions of these routines, and with different degrees of complexity, as shown in the evolution of the descriptive categories emerging from the field. In this regard, routines would require coordination to become a single one, although temporarily singular (ontological singularity), through transient and unstable achievements (D’Adderio, 2021). This cohesion is continually challenged by the multiplicity of

patterns and performances due to sociomaterial agency that arises from their engagement in routines (Costa *et al.*, 2024). Therefore, actors are not the main agents in the routine, but the sociomaterial assemblage that builds it up and affects it considerably (D’Adderio, 2021).

The findings also shed light on practical approaches to organizational strategy, stressing the relevance of understanding how individuals perceive software solutions in their organizational routines. Therefore, software implementation goes beyond a strategic decision; it involves a *continuum* of practices that emerge and progress as different groups within the organization conceptualize both the technology and the solutions integrated into their routines.

5. Conclusions and recommendations

This paper aimed to understand how employees of an oil company perceive the role of software solutions in carrying out their organizational routines. As a theoretical contribution, it indicates that, as artifacts are embedded and appropriated by actors in an increasingly central way in routines, as shown by the evolution of descriptive categories, artifacts tend to reduce and format human agency in carrying out the actions. Incorporating digital elements into routines is influenced by how actors accept them, from simple external elements, passing through structuring components, up to the prevalence of artifacts in implementing actions, as suggestive components of routines. These findings contribute to the expansion of academic knowledge on the function and relevance of software solutions in organizations, providing a basis for future research and theoretical developments.

The article contributes to understanding the significance of how different actors notice the use of technology in a broader social context as a critical success factor for the adoption of new solutions. As a methodological contribution, phenomenography, already an important practice in organizational studies, reveals how the sociomaterial assemblage can be built from the fluid progression of actors’ conceptions of routines in their appropriation of artifacts. As practical contributions, we suggest that: (1) automation does not restrain actors’ autonomy in their routines too much; and (2) it is better to automate activities that add value to the process. Studies involving companies’ middle/top management positions could contribute to advancing our results.

Based on them, we suggest further studies on potential efficiency gains upon adopting digital transformation in administrative services in general, both at companies in other industries and in public services provided to society. An important implication for public policies is to consider the experiences of individuals whose routines are affected by technologies, as well as their level of digital education. This could provide valuable insights for policymakers, helping them take decisions on digitalization that reflect the perceptions of end users. In addition, the concern expressed by some people about the potential depersonalization of work aroused curiosity of carrying out a study on the digitalization of administrative work, from the perspective of organizational culture. Finally, regarding organizational routines, we suggest a study with longitudinal focus on routine dynamics in an environment with increasing digitalization.

Note

1. FAG stands for managerial assignment form.

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